5 ANALYSIS OF EFFECTS

5.1 Resuspension of Sediments from Removal of Pipeline

As stated in the Section 1, the proposed Action would require the removal of the pipeline and riprap on the shoreline which would be replaced after the final segment of pipeline is removed and the landward section is sealed. Removal of the pipeline and riprap would result in short-term disturbance of bottom sediments and resuspension of sediments. Disturbed or resuspended sediments could increase the exposure of chemical concentrations to aquatic receptors in the localized area and could result in adverse water quality and biological effects.

Temporary resuspension of sediments in the water column can lower levels of dissolved oxygen and possibly release chemicals present in the sediments into the water column. The concentration of suspended sediments will vary based on the production rate of removal and duration of the construction activity, and would depend also on the methods used, the quality of equipment, and care of the operator. In all cases, increased turbidity levels would be relatively short-lived and generally confined to within a few hundred feet of the activity depending on current velocity, tidal cycle and wind. After initially high levels of resupsended sediment, sediments would disperse and background levels would be restored within hours of disturbance.

The potential effects of suspended sediment within the water column on fish include gill lacerations (at very high and prolonged exposures), increased “coughing” behavior, decreased feeding success, and avoidance behaviors (Wilber and Clarke 2001). Removal of the pipeline has the potential to resuspend sediment in the immediate vicinity of extraction of the pipeline. The maximum volume of sediment disturbed by this operation would consist of the volume of sediment within a 50ft section of pipeline, a 1ft radius and a 2ft depth surrounding the portion of pipeline being pulled above the mudline surface. This volume equates to approximately 3.7 cubic yards per 50 ft section if all the sediment above and surrounding the 8inch pipeline were dispersed into the water column during extraction. In total, to remove the 2,000 ft of pipeline approximately 40 – 50 ft sections will be removed which equates to 148 cubic yards of sediment potentially being disturbed. It should be noted that this is a worst case scenario as approximately 800 ft of the pipeline is on the surface of the mud and not submerged. Futhermore, it is unlikely that the entire volume of sediment would be dispersed. As stated in Section 1 the pipeline is only 8 inches in diameter and the surrounding sediment is not significantly consolidated, it will move through the mud to the surface. As it traverses through the mud, the sediment will fall in upon the void below. Sediment would only be resuspended at the point where the pipeline is pulled above the

mudline into the water. It is anticipated that only a small percentage of the total volume would be resuspened at the point of extraction.

In comparison, even a small dredging Project would disturb upwards of 5,000 cubic yards per day. In addition, the sediment plumes that may be caused by the sections of pipeline removed are expected to be extremely small in area and short in duration. Based on studies of recent projects by the USACE, it is estimated that any potential impact due to resuspended sediments would be limited to a distance up and down current of approximately 100 feet (USACE, 2004). Recent studies by the San Francisco Estuary Institute (SFEI, September 2008) determined that the short term effects of dredging on sensitive fish species due to dredging activities would be minor. Considering that the volume of sediment being disturbed by removal of the pipeline would be a significantly smaller fraction (order of magnitude) of that disturbed by even a small scale dredging operation, it can be assumed that the water quality impacts of pipeline removal would be smaller still and well below the threshold of concern.

Resuspended sediment levels caused by natural phenomena such as floods, storms, large tides, and winds are often higher and of longer duration than those caused by dredging, especially in lakes and bays. Previous studies have demonstrated that marine organisms are accustomed to sediment resuspension levels greater than those generated by dredging (Stern and Stickle 1978, Parr et al. 1998, Environment Canada 1994, Pennekamp et al. 1996, Herbich 2000) or even the pipeline removal. Resuspended sediment concentrations within San Francisco Bay have been reported between 100-200 mg/L due to tidal influence alone (Buchanan and Schoellhamer 1996; Schoellhamer 1996). As stated above, normal circulation and strong currents along the waterfront rapidly circulate and disperse water temporarily affected by construction activities. Turbidity plumes would disperse within a matter of hours, and the particulate concentrations would be diluted to levels that would pose no major threat to water quality or aquatic wildlife.

The chemistry from sediment characterization of these sediments indicates that metal concentrations were similar to or below San Francisco Bay (SF Bay) background levels (SFRWQCB 1998). While the cadmium level was slightly above SF Bay background levels, it was below the cadmium Effects Range-Low (ER-L) of 1.2 mg/kg (Long et al 1995) and is unlikely to cause an adverse biological effect. Organotins and organochlorine pesticides were below their respective MDLs. Total PAHs, total PCBs, and total DDTs were reported at 1,207 µg/kg, 19.3 µg/kg and 0 µg/kg, respectively; each was below SF Bay background levels (SFRWQCB 1998). In addition, a suspended sediment bioassay was performed on the Project site sediment which did not exhibit toxicity. Based on these results, sediments that may be displaced or resuspended during the removal of the Hercules pipeline would not represent an adverse environmental impact to species in the immediate or general vicinity of operations.

Suspended sediment effects on fish

In order to evaluate the potential biological effects of resuspended sediments on the physiology of marine organisms, many different laboratory studies have attempted to determine the levels of suspended sediments that cause impacts. Peddicord and McFarland (1978) found that most of the fish and invertebrates studied could withstand levels of resuspended sediments of up to 250 to 400mg/L for a period of about 9 to 10 days without effect. Table 5-1 presents results from typical studies that have been conducted at which effects are noted. A more extensive table is available in Clarke and Wilber (2000).

Table 5-1
Response of Marine Species to a Certain Concentration Level of Suspended Sediments

Study	Species	Concentration (mg/L)	Response
Chiasson 1993	Rainbow Smelt *Osmerus Mordax*	10	Increased swimming behavior
Peddicord and McFarland 1978	Most fish and invertebrate	250-400	No effect
Auld and Shubel 1978	American Shad larvae	500	32% mortality after 4 days of exposure
Sherk et al. 1974 and 1975	White Perch	650	Elevated hematocrit levels after 5 days of exposure.
Sherk et al. 1974 and 1975	Striped Bass	1,500	Elevated hematocrit levels after 14 days of exposure
Nightingale and Simenstad 2001	Fish	4,000	Exhibits of erosion at gill filament tips
McFarland and Peddicord 1980	Shiner Perch	6,000	50% mortality
Ross 1982	Chinook Salmon smolts	11,000	50% mortality after 96 hours of exposure

As presented in Section 4 encounter rates for listed species will be minimal. Green sturgeon, salmonids, longfin smelt, and delta smelt in the estuary commonly encounter areas of increased turbidity due to storm flow runoff events, wind and wave action, and benthic foraging activities of other aquatic organisms. Fish may be expected to avoid areas of high turbidity (e.g., see Berg and Northcote 1985) and return when concentrations of suspended solids are lower. Moreover, as emphasized by Wilber and Clarke (2001), the short duration of expected encounters with the Project are an important aspect that minimize any expected effects of sediment suspension. The minor and localized areas of turbidity associated with this Project's construction is not expected to result in harm or injury, or behavioral responses that impair migration, foraging, or make listed fish more susceptible to predation. If green sturgeon, salmonids, longfin smelt or delta

smelt temporarily relocate from areas of increased turbidity, areas of similar value are available in San Pablo Bay adjacent to the work site which offer habitat of equal or better value for displaced individuals. Adjacent habitat areas also provide adequate carrying capacity to support individuals that are temporarily displaced during the Project's construction activities. Even if they encounter potentially resuspended sediments it is unlikely that the duration and exposure would be significant to cause adverse impacts.

5.2 Potential impacts to benthic habitat

As stated previously the benthic habitat of the area where the pipeline will be removed as well as where the barge may ground during extreme low tides will be temporarily disturbed by these activities. These activities may result in physical displacement, habitat disturbance, and short-term temporary loss of foraging area for special-status fish such as, green sturgeon, salmonids, longfin smelt, and delta smelt and Fishery Management Plan managed groundfish. Potential total short-term habitat loss for these activities is estimated at less than 0.93 acres which includes the length of the pipeline, a 20 ft buffer surrounding the pipeline, the barge, and riprap area.

Altering benthic habitat and associated infaunal and epifaunal communities can result in the loss or reduction of suitability as fish foraging habitat, especially for sensitive species including salmon, steelhead, green sturgeon, and groundfish. Following pipeline removal and replacement of rip rap on the shoreline, the deposition of fine sand-mud sediments, comparable to pre-removal conditions, would begin almost immediately and the benthic community inhabiting those sediments is expected to recover to pre-Project composition and abundances within a few months to up to two years, depending on when dredging occurs and other ecological factors affecting recolonization (Newell et. al. 1998). Based on the very small area of San Pablo Bay affected, the temporary time period over which the habitat would be unavailable for use by sensitive species, and the overall temporary nature of the loss, the potential loss of seafloor habitat from the action is expected to be undetectable.